

*Estimate of the Number of Stars within Certain Limits
of Proper Motion.* By W. G. Thackeray.

The following data are derived from discussions of statistics of proper motions, published (1) by Prof. Auwers in the introduction of the Berlin "A" Catalogue of the Astronomische Gesellschaft series, pp. 141-143, where he discusses the Bradley proper motion referred to here as "Bradley," as well as certain of his zone stars referred to here as "Auwers," and though the separation of the stars is not in all cases identical with the grouping adopted in this paper, it is quite near enough for the purposes of this paper; (2) by Prof. Dyson and myself in the introduction to the New Reduction of Groombridge's Catalogue, p. xcii; and (3) by myself on some Carrington proper motions, published in the present volume of the *Monthly Notices*. The Bradley observations extend over the northern sky, Groombridge's lie within 52° of the pole, Carrington's within only 9° , and the Berlin "A" series are within the zone of $+15^\circ$ to $+20^\circ$ of Declination. The material under discussion cannot be considered to extend beyond 9.4 magnitude stars, but from the results it would appear as though the adopted percentages might be used further without much risk of appreciable error.

The agreement between the different catalogues is especially good for the fainter stars, and suggests the absence of any serious systematic error.

Percentage of Stars within Certain Limits of Centennial Proper Motions.

Authority.	$0'' - 5''$	$5'' - 10''$	$10'' - 20''$	$> 20''$	No. of Stars.
Magnitude 1-4.9.					
Bradley . . .	42	22	18	18	711
Groombridge .	45	21	20	14	234
	43	22	18	17	
Magnitude 5.0-5.9.					
Bradley . . .	49	26	16	9	951
Groombridge .	59	21	14	6	538
	55	23	15	7	
Magnitude 6.0-6.9.					
Bradley . . .	52	29	13	6	1367
Groombridge .	66½	21	8	4½	1149
	60	25	10	5	

Authority.	0''-5''	5''-10''	10''-20''	>20''	No. of Stars.
Magnitude 7·0-7·9.					
Bradley . . .	55	26	13	6	188
Groombridge . .	74	18	5½	2½	1369
Auwers . . .	76	14	7	2	1420
Carrington . .	64	22	12	2	114
	75	17	6	2	
Magnitude 8·0-8·4.					
Groombridge . .	78½	17	2½	2	940
Auwers . . .	80	11	7	2	1595
Carrington . .	69	19	9	4	179
	79	14	5	2	
Magnitude 8·5-9·0.					
Auwers . . .	77	18	4	1	3366
Carrington . .	79	13	7	1	442
	78	15	6	1	
Magnitude 9·0-9·4.					
Auwers . . .	79	13	7	1	1022
Carrington . .	80	15	5	1	378
	79	14	6	1	

With reference to the estimate of the number of the stars for the adopted groups of magnitude, Seeliger gives for the counts in the B.D. for the northern hemisphere the following figures :—

Mag. 1 -6·5	4,120 stars.
6·6-7·0	3,887
7·1-7·5	6,054
7·6-8·0	11,168
8·1-8·5	22,898
8·6-9·0	52,852
9·1-9·5	213,973
Total	314,952

and on this (Argelander) scale there would be 630,000 in the whole sky.

To exclude the 9·5 stars from this estimate, I have counted the number of 9·5 stars on thirteen pages in different volumes of the B.D., which gave 98, 95, 107, 107, 100, 125, 81, 124, 143, 131, 93, 75, and 105 respectively, or an average of 106·5 out of every 300

stars, say 35 per cent. Excluding these, the number of stars down to 9.4 magnitude would thus be some 400,000.

The adopted values of the numbers for the different groups of magnitudes, and the percentage values within certain limits of proper motion, are given in the following table :—

Percentage of Stars within Certain Limits of Centennial Proper Motions in Order of Magnitude, with Estimated Number of Stars.

Mag.	0" - 5"	5" - 10"	10" - 20"	> 20"	Estimated No. of Stars in Thousands.
1 -4.9	43	22	18	17	1
5.0-5.9	55	23	15	7	3
6.0-6.9	60	25	10	5	12
7.0-7.9	75	17	6	2	35
8.0-9.4	79	14	6	1	350

Estimated Number of Stars within Certain Limits of Centennial Proper Motions in Order of Magnitude.

1 -4.9	430	220	180	170	1
5.0-5.9	1,650	690	450	210	3
6.0-6.9	7,200	3,000	1,200	600	12
7.0-7.9	26,250	5,950	2,100	700	35
8.0-9.4	276,500	49,000	21,000	3,500	350
	312,030	58,860	24,930	5,180	401

From a comparison of the Groombridge and Carrington proper motions, for the purpose of estimating the effect of accidental error, the probable error of a centennial proper motion in N.P.D. is $\pm 0''.8$ and in R.A. $\pm 0''.9$; thus the probable error of a resultant centennial proper motion is $\pm 1''.2$. It would, therefore, be reasonable to infer that the numbers corresponding to these limits of proper motion would not be liable to any serious alteration for the effect of accidental error of observation.

If the group 0" - 5" is further broken up it will be found that for all magnitudes the stars tend to accumulate somewhere round 2''.5 as a resultant centennial proper motion, and this seems too large a quantity to be due to systematic or accidental error.

Notes on some Proper Motions derived from a Comparison of Carrington's Catalogue with the Greenwich Places for 1900.
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In the Greenwich Catalogue for 1900, which is now in course of construction, there are 1185 stars to be found in Carrington's Circumpolar Catalogue for 1855. Of these stars, 94 common to the Groombridge-Greenwich system have been used to discuss the